

NOISE REDUCTION STUDY WITHIN MARICOPA COUNTY

FINAL NOISE STUDY TECHNICAL REPORT

JUNE 2008

Prepared for:



**MARICOPA
ASSOCIATION of
GOVERNMENTS**

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EXECUTIVE SUMMARY

The Maricopa Association of Governments (MAG) has identified several locations where traffic noise could be mitigated using Proposition 400 funds. These funds are intended to mitigate traffic noise in residential areas where the noise levels have increased due to higher traffic volumes on the MAG Regional Freeway System. This would allow for the reduction of traffic noise levels in areas that are not eligible (**lower noise levels than the Arizona Department of Transportation's [ADOT] Noise Abatement Policy Action Level**) for noise mitigation through the normal ADOT process.

Noise level monitoring was conducted to determine the existing noise level conditions. Monitoring was conducted during the morning peak travel time from 5:30 AM to 9:00 AM and afternoon peak travel time from 3:30 PM to 7:00 PM. A peaceful subdivision in Maricopa County is considered quiet at 40 to 50 "A"-weighted decibels (human hearing range). An urban freeway shoulder in Maricopa County is considered noisy at 70 to 80 "A"-weighted decibels (human hearing range). The average monitored noise levels ranged from 50 to 66 "A"-weighted decibels.

Reduction was considered for customers (homes) in the form of noise barriers. The following table summarizes the recommended barrier cost.

BARRIER SUMMARY					
Barrier Description	Jurisdiction	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost*
Barrier 01	Phoenix	1,353	10-14	15,078	\$603,120
Barrier 02	Phoenix	2,738	14-18	41,638	\$1,775,040
Barrier 03	Phoenix	1,521	12-16	23,563	\$1,003,360
Barrier 04	Phoenix	1,452	16-18	24,519	\$867,207
Barrier 05	Peoria	2,693	14-20	44,546	\$1,842,320
Barrier 06	Peoria	5,115	14-20	86,596	\$3,668,440
Barrier 07	Peoria	2,110	12-16	30,553	\$1,222,120
Barrier 08	Scottsdale	1,757	10-18	27,251	\$1,160,320
Barrier 09	Scottsdale	2,125	12-14	29,100	\$1,249,000
Barrier 10	Phoenix	1,899	12-16	24,301	\$992,040
Barrier 11	Maricopa County	2,283	8-16	28,935	\$1,248,720
Total for Barriers:		25,046	8-20	376,080	\$15,631,687

* The unit cost of barriers was assumed at \$40.00 per square foot.

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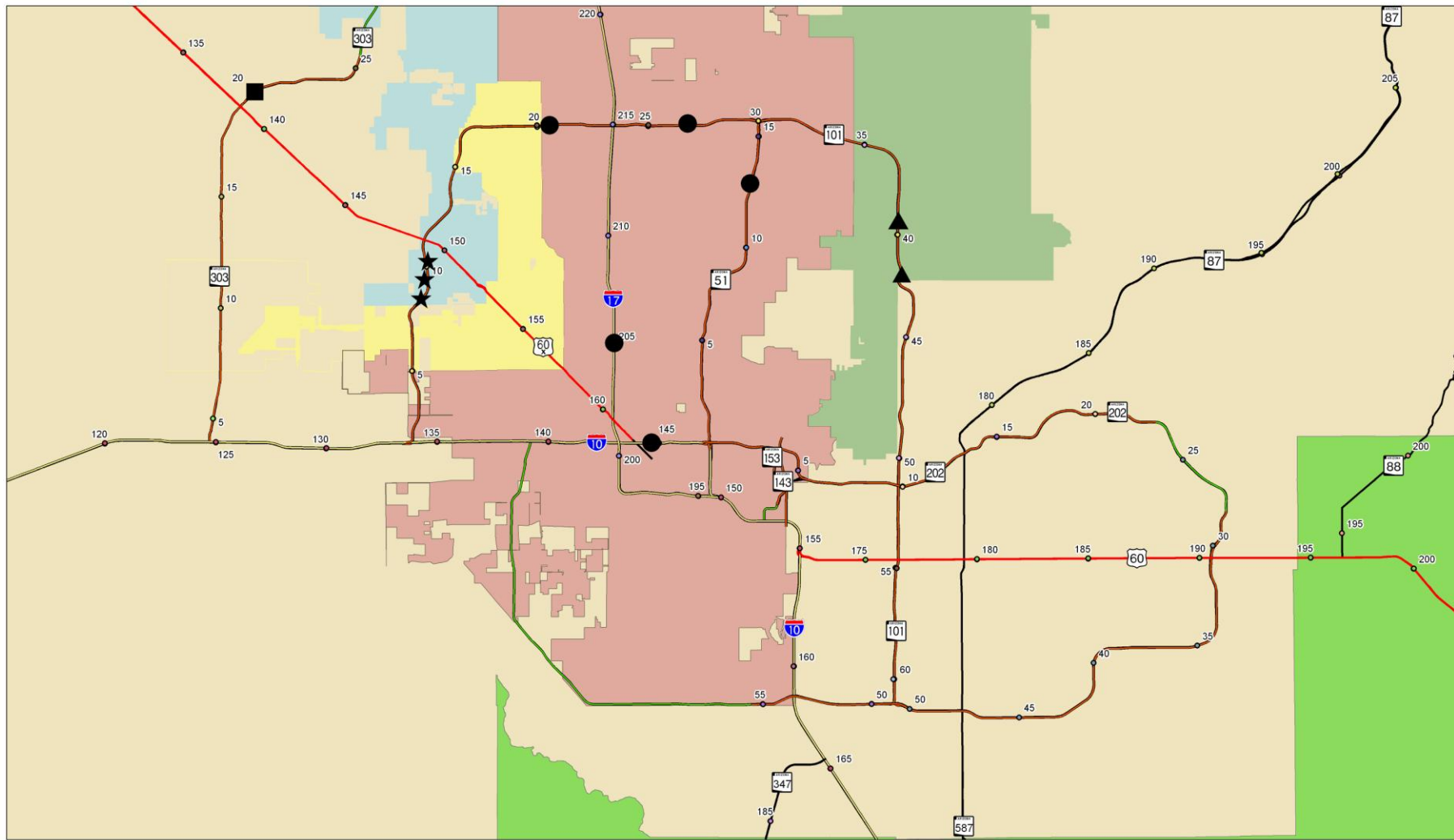
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1.0 INTRODUCTION

This noise reduction study was developed to focus on the areas that were chosen as possible noise reduction sites and prioritized accordingly. There were originally 15 proposed noise-sensitive locations submitted by member governments. Upon initial screening, 11 potential noise reduction locations were identified for further noise analysis. The Federal Highway Administration's (FHWA) approved Traffic Noise Model (TNM) 2.5 was used to predict traffic noise levels and to conduct the noise reduction analysis for these 11 locations. The locations for these 11 potential noise reduction areas are shown in Figure 1.

The unit cost of the barriers was assumed at \$40 per square foot and the unit cost for removal of existing privacy wall and noise wall was assumed at \$40 per linear foot.



POTENTIAL NOISE REDUCTION LOCATIONS

● City of Phoenix	★ City of Peoria
▲ City of Scottsdale	■ Maricopa County

Figure 1. Potential Noise Reduction Locations

2.0 POTENTIAL NOISE BARRIER LOCATIONS

Eleven locations (refer to Appendix A) were selected for further noise reduction analysis. These locations were located within the jurisdiction of the City of Phoenix, City of Scottsdale, City of Peoria, and unincorporated portions of Maricopa County.

Noise reduction locations in the **City of Phoenix**:

- I-17 and Camelback Road, southeast corner (SEC)
- Interstate 10 (I-10) 7th Avenue to 15th Avenue, north side
- State Route (SR) 101 (Agua Fria Freeway) and 51st Avenue (SEC)
- SR 101 and 7th Street, northeast corner (NEC)
- SR 51 and Greenway Parkway, northwest corner (NWC)

Noise reduction locations in the **City of Peoria**:

- SR 101, Peoria Avenue to Grand Avenue, east side
- SR 101, Olive Avenue to Peoria Avenue, west side
- SR 101, Northern Avenue to Olive Avenue, west side

Noise reduction locations in the **City of Scottsdale**:

- SR 101 and 90th Street, NWC
- SR 101 and Cactus Road, NWC

Noise reduction location in unincorporated portions of **Maricopa County**:

- SR 303, Deer Valley Road to north of Robertson Drive

3.0 GENERAL DESCRIPTION OF NOISE MODELING

3.1 Existing Noise Levels

Existing noise sensitive land uses in the vicinity of the project limits were identified using land use maps, aerial photography, and site inspection.

Noise level monitoring was conducted to determine the existing noise level conditions (monitor location numbers are labeled “MON” on figures). Monitoring was conducted during the morning peak travel time from 5:30 AM to 9:00 AM and afternoon peak travel time from 3:30 PM to 7:00 PM. The average monitored noise levels ranged from 50 to 66 dBA. Table 1 shows monitoring noise levels for the 26 locations.

The monitoring noise levels represent the general noise environment of the neighborhoods adjacent to the freeways. Detailed noise level monitoring log results are located in Appendix B of this report.

TABLE 1
Noise Level Monitoring Results

Jurisdiction	Monitor Number	Address/Description	Freeway	First Monitoring Results		Second Monitoring Results ¹			
				Leq, dBA	Time	AM Peak Noise		PM Peak Noise ³	
						Leq, dBA	Time	Leq, dBA	Time
Phoenix	MON-01	NE of West Highland Avenue and Black Canyon Highway frontage road	I-17	66 ²	2:00-2:20 PM	64	7:00-7:20 AM	63	3:10-3:30 PM
	MON-02	NWC, 9th Avenue and Moreland Street	I-10	59	7:00-7:20 AM	60	5:40-6:00 AM	59	6:10-6:30 PM
	MON-03	NWC, 11th Avenue and Moreland Street	I-10	61	7:30-7:50 AM	58	8:10-8:30 AM	61	6:30-6:50 PM
						62	6:10-6:30 AM		
	MON-04	NWC, 13th Avenue just south of Culver Street	I-10	62 ²	8:00-8:20 AM	61	6:15-6:35 AM	---	---
						57	8:20-8:40 AM		
	MON-05	4762 West Menadota Drive	SR 101	61 (backyard)	6:35-6:55 AM	57 (frontyard)	7:30-7:50 AM	---	---
Peoria	MON-06	Playground, SEC, West Menadota Drive and North 48th Lane	SR 101	58	6:02-6:22 AM	---	---	52	3:30-3:50 PM
	MON-07	SWC, North 10th Place and East Pontiac Drive	SR 101	62 ²	1:00-1:20 PM	60	6:10-6:30 AM	59	5:20-5:30 PM
	MON-08	Behind the first row in the Mobile Home Park	SR 101	56	9:20-9:40 AM	60	6:50-7:10 AM	---	---
	MON-09	In front of the first row in the Mobile Home Park	SR 101	62 ²	9:45-10:05 AM	60	7:15-7:35 AM	60	4:00-4:10 PM
								61	4:55-5:05 PM
	MON-10	SW of West Yucca Street and North 93rd Avenue	SR 101	59 ²	10:20-10:40 AM	58	7:15-7:35 AM	---	---
	MON-11	SW of North 92nd Drive and West Sanna Circle	SR 101	59	7:30-7:50 AM	61	8:15-8:35 AM	60	3:30-3:50 PM
	MON-12	SW of North 92nd Drive and West Mountain View Road	SR 101	62	7:55-8:15 AM	63	7:50-8:10 AM	---	---
Scottsdale	MON-13	Northwest of West Mountain View Road between 92nd Drive and 94th Avenue	SR 101	50	8:20-8:40 AM	53	8:25-8:45 AM	---	---
	MON-14	Northwest of 92nd Drive and West Monroe Street	SR 101	61	8:50-9:10 AM	63	7:50-8:10 AM	---	---
	MON-15	Northwest of North 95th Avenue and West Las Palmaritas Drive	SR 101	60	2:25-2:45 PM	64	6:00-6:20 AM	55	3:00-3:10 PM
	MON-16	SWC, end of the cul-de-sac at East San Rafael Drive	SR 101	58	9:05-9:25 AM	59	6:20-6:40 AM	53	3:50-4:10 PM
Phoenix	MON-17	West side of freeway south of East Via Linda	SR 101	59	9:40-10:00 AM	61	6:20-6:40 AM	57	3:25-3:45 PM
	MON-18	SWC, Larkspur Drive and 87th Street	SR 101	58	10:15-10:35 AM	59	7:05-7:25 AM	54	4:20-4:40 PM
	MON-19	SWC, Sweetwater Avenue and 87th Street	SR 101	53	10:40-11:00 AM	56	7:10-7:30 AM	51	4:50-5:10 PM
Maricopa County	MON-20	NWC, East Waltann Lane and 35th Street	SR 51	56	12:15-12:35 PM	56	7:00-7:20 AM	53	4:00-4:10 PM
Glendale ⁴	MON-21	15435 West Robertson Drive	SR 303	56	6:57-7:17 AM	59	5:50-6:10 AM	57	5:05-5:25 PM
	MON-22	Northwest of West Kerry Way and North 79th Drive	SR 101	58	10:55-11:15 AM	63	6:00-6:20 AM	55	4:30-4:40 PM
	MON-23	NE of North 77th Avenue and West Escuda Road	SR 101	55	11:30-11:50 AM	59	6:15-6:35 AM	---	---
						59	6:50-7:10 AM	---	---
	MON-24	SE of West Beardsley Road and Arrowhead Lakes Condominiums	SR 101	60 ²	12:40-1:00 PM	56	8:30-8:50 AM	---	---
						61	7:30-7:50 AM	---	---
Glendale ⁴	MON-25	SW of North 53rd Avenue and West Escuda Road	SR 101	58	1:10-1:30 PM	61	7:30-7:50 AM	---	---
	MON-26	SW of North 70th Drive and cul-de-sac	SR 101	58 ²	1:45-2:05 PM	56	6:55-7:15 AM	58	5:30-5:40 PM

- Notes:
1. The noise levels in the AM peak are normally greater than in the PM peak, which is due to temperature inversion effects.
 2. Some off-peak noise levels are higher than that in the AM peak, which is due to more traffic using frontage and local roads during the off-peak hours.
 3. Noise levels were spot checked in PM peak to ensure they are lower than noise levels in AM peak.
 4. Noise levels were conducted in the City of Glendale for information purposes only. Noise analysis was excluded because noise barriers have been built in the City.

The modeled noise receiver locations are denoted as “1_N_1”, where the first “1” is the geographical location number. The “N” means the location is on the northbound direction of the roadway (“S” for the southbound direction of the roadway). The last “1” that follows the “N” (or “S”) is a sequential number assigned to the noise receiver.

Table 2 shows the description of the locations and the number of modeled noise receivers in each location. Aerial graphics included in Appendix A shows the locations of the customers.

TABLE 2 LOCATION OF MODELED NOISE RECEIVERS		
Location	Number of Modeled Noise Receivers	Description of Location
01	3	Phoenix, I-17 & Camelback Road (SEC)
02	19	Phoenix, I-10, 7th Avenue to 15th Avenue (north side)
03	21	Phoenix, SR 101 & 51st Avenue (SEC)
04	13	Phoenix, SR 101 & 7th Street (NEC)
05	25	Peoria, SR 101, Peoria Avenue to Grand Avenue (east side)
06	34	Peoria, SR 101, Olive Avenue to Peoria Avenue (west side)
07	17	Peoria, SR 101, Northern Avenue to Olive Avenue (west side)
08	18	Scottsdale, SR 101 & 90th Street (NWC)
09	20	Scottsdale, SR 101 & Cactus Road (NWC)
10	14	Phoenix, SR 51 & Greenway Parkway (NWC)
11	17	Maricopa County, SR 303, Deer Valley Road to north of Robertson Drive
Total Number of Modeled Noise Receivers		201

3.2 TNM 2.5 Modeling and Future Noise Level Impacts

This analysis utilized the FHWA-approved highway noise computer model TNM 2.5 for the noise level computations and noise reduction analysis. FHWA criteria specify that the noisiest condition be modeled. For this project, the noisiest condition is associated with the traffic volume that would result in the Level of Service (LOS) “C” for the operational characteristics of the roadway. Traffic volumes and traffic mix were derived from previous noise studies and Maricopa County traffic projections for 2030. Detailed traffic data for this noise study are shown in Appendix C. Input assumptions for the TNM 2.5 model are shown in Table 3.

TABLE 3 FHWA TNM 2.5 INPUT ASSUMPTIONS		
Item Number	Description	Assumption
1	Ground Type	Hard Soil
2	Pavement Type	Average (TNM 2.5 Default)
3	Modeled Traffic Speed, freeway mainline segment	70 mph
4	Modeled Traffic Speed, ramp segment	55 mph
5	Modeled Traffic Speed, frontage road	50 mph
6	Modeled Traffic Speed, cross street	45 mph
7	Receiver Height Above Ground	5 ft
8	Number of Modeled Noise Receivers	201

The horizontal and vertical geometry of the existing roadway and coordinates for noise receiver locations utilized in this analysis were obtained from Maricopa County Geographic Information System topographic data, as-built plans and digital terrain models. The existing berms, and privacy wall locations, and elevations were identified from aerial photo interpretation and verified by field inspection. The aerial photographs used were taken in 2006.

Per ADOT’s direction, noise reduction due to the existing rubberized asphalt (quiet pavement) was taken into account when predicting future noise levels. A 4 dBA noise reduction credit for quiet pavement was applied towards predicted noise levels for modeled locations along SR 101, SR 51, I-17, and I-10. These highways were rubberized as indicated in *Progress Report No. 2 Quiet Pavement Pilot Program*, dated December 2006. For SR 303, there was no indication in the progress report that rubberized pavement was implemented and therefore none was taken into account.

4.0 NOISE MODELING RESULTS

The results of the noise modeling and recommended noise reduction are shown in Appendix A and in Tables 4 through 25. The unit cost of the barriers was assumed at \$40 per square foot and the unit cost for removal of existing privacy wall and noise wall was assumed at \$40 per linear foot. In this report, existing privacy walls and noise barriers, which conflict with the new recommended barriers would be assumed to be removed.

LOCATION 01

Location 01 is located on the SEC between I-17 and Camelback Road in the City of Phoenix. As shown in Table 4, location 01 has three modeled noise receivers, representing approximately 16 adjacent customers. The noise levels at two modeled noise receivers are equal to or greater than 64 dBA, representing approximately five impacted customers.

TABLE 4 PREDICTED NOISE LEVEL RESULTS LOCATION 01					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
1_N_1/MON-01	66	73	63	10	Barrier 01
1_N_2		59	55	4	
1_N_3		70	61	9	
	- Modeled Receivers ≥ 64 dBA				

Noise receivers 1_N_1/MON-01, 1_N_2, and 1_N_3 represent the common outdoor activity areas of the two-story condominium. Noise reduction was considered for this condominium since the predicted noise levels are above 64 dBA.

Barrier 01 is recommended for customers at this condominium. Barrier 01 is a combination of two overlapping separate barriers. Due to access road constraints, one separate barrier was designed between the frontage road and freeway mainline. Barrier 01 would provide noise attenuation for five impacted customers on the first row. The height of the barrier would be approximately 10 to 14 feet. The barrier cost is shown in Table 5.

TABLE 5 BARRIER SUMMARY LOCATION 01				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 01 (Phoenix, I-17 and Camelback Road)	1,353	10-14	15,078	\$603,120

LOCATION 02

Location 02 is a historic neighborhood located on the north side of I-10 between 7th Avenue and 15th Avenue in the City of Phoenix. There is an existing noise barrier along the 7th Avenue on-ramp with heights of 9 to 10 feet as measured on the residential side. As shown in Table 6, location 02 has 19 modeled noise receivers, representing approximately 57 adjacent customers. The noise levels at 16 modeled noise receivers are equal to or greater than 64 dBA, representing approximately 51 impacted customers.

TABLE 6 PREDICTED NOISE LEVEL RESULTS LOCATION 02					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
2_W_1		64	63	1	Barrier 02
2_W_2		64	61	3	
2_W_3		64	62	2	
2_W_4		61	58	3	
2_W_5/MON-02	60	65	62	3	
2_W_6		65	62	3	
2_W_7		62	59	3	
2_W_8		66	63	3	
2_W_9		63	59	4	
2_W_10		67	63	4	
2_W_11/MON-03	62	68	63	5	
2_W_12		65	60	5	
2_W_13		66	61	5	
2_W_14		66	62	4	
2_W_15		66	62	4	
2_W_16/MON-04	62	65	61	4	
2_W_17		64	61	3	
2_W_18		64	62	2	
2_W_19		67	66	1	

 - Modeled Receivers \geq 64 dBA

Barrier 02 is recommended for customers in this neighborhood. Barrier 02 is a combination of two overlapping noise walls, which are designed at the location of the existing noise barrier along the ramp and on the berm area. Barrier 02 would provide noise attenuation for 50 impacted customers. The height of the barrier would be approximately 14 to 18 feet on the residential side. The barrier cost is shown in Table 7.

TABLE 7 BARRIER SUMMARY LOCATION 02				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 02 (Phoenix, I-10, 7th Avenue to 15th Avenue)	2,738	14-18	41,638	\$1,775,040*
* Barrier cost includes remove and replace fee of \$109,520 for the existing noise barrier (2,738 ft).				

LOCATION 03

Location 03 is located on the SEC at SR 101 & 51st Avenue in the City of Phoenix. As shown in Table 8, location 03 has 21 modeled noise receivers, representing approximately 80 adjacent customers. The noise levels at 15 modeled noise receivers are equal to or greater than 64 dBA, representing approximately 56 impacted customers.

TABLE 8 PREDICTED NOISE LEVEL RESULTS LOCATION 03					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
3_E_1		66	59	7	Barrier 03
3_E_2		66	60	6	
3_E_3		65	60	5	
3_E_4		66	60	6	
3_E_5/MON-05	61	67	60	7	
3_E_6		67	61	6	
3_E_7		67	61	6	
3_E_8		66	61	5	
3_E_9		64	63	1	
3_E_10		62	61	1	
3_E_11		58	57	1	
3_E_12		58	56	2	
3_E_13		59	58	1	
3_E_14		62	62	0	
3_E_15		63	61	2	
3_E_16		64	61	3	
3_E_17		64	60	4	
3_E_18/MON-06	58	65	59	6	
3_E_19		66	63	3	
3_E_20		64	60	4	
3_E_21		64	61	3	

- Modeled Receivers \geq 64 dBA

Barrier 03 is recommended for customers in this neighborhood. Barrier 03 would replace the existing 8 foot privacy wall and wrap around the corner area on both ends of the neighborhood. Barrier 03 would provide noise attenuation for 56 impacted customers. The height of the barrier would be approximately 12 to 16 feet. The barrier cost is shown in Table 9.

TABLE 9 BARRIER SUMMARY LOCATION 03				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 03 (Phoenix, SR 101 & 51st Avenue, SEC)	1,521	12-16	23,563	\$1,003,360 *
* Barrier cost includes remove and replace fee of \$60,840 for the existing privacy wall (1,521 ft).				

LOCATION 04

Location 04 is located at the NEC at SR 101 & 7th Street in the City of Phoenix. As shown in Table 10, location 04 has 13 modeled noise receivers, representing approximately 44 adjacent customers. The noise levels at 13 modeled noise receivers are equal to or greater than 64 dBA, representing approximately 44 impacted customers.

TABLE 10 PREDICTED NOISE LEVEL RESULTS LOCATION 04					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
4_W_1		68	62	6	Barrier 04
4_W_2		68	62	6	
4_W_3/MON-07	62	68	63	5	
4_W_4		67	63	4	
4_W_5		65	61	4	
4_W_6		68	63	5	
4_W_7		68	61	7	
4_W_8		67	61	6	
4_W_9		67	61	6	
4_W_10		67	61	6	
4_W_11		67	63	4	
4_W_12		67	65	2	
4_W_13		66	64	2	
	- Modeled Receivers ≥ 64 dBA				

Barrier 04 is recommended for customers in this neighborhood. Barrier 04 would replace the existing 8 foot privacy wall and wrap around the corner area on both ends of the neighborhood. Barrier 04 would provide noise attenuation for 41 impacted customers. The height of the barrier would be approximately 16 to 18 feet. The barrier cost is shown in Table 11.

TABLE 11 BARRIER SUMMARY LOCATION 04				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 04 (Phoenix, SR 101 & 7th Street, NEC)	1,452	16-18	24,519	\$867,207*
* Barrier cost includes remove and replace fee of \$58,080 for the existing privacy wall (1,452 ft).				

LOCATION 05

Location 05 is located on the east side of SR 101 between Peoria Avenue and Grand Avenue in the City of Peoria. As shown in Table 12, location 05 has 25 modeled noise receivers, representing approximately 63 adjacent customers. The noise levels at 20 modeled noise receivers are equal to or greater than 64 dBA, representing approximately 52 impacted customers.

TABLE 12 PREDICTED NOISE LEVEL RESULTS LOCATION 05					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
5_N_1		67	62	5	Barrier 05
5_N_2		68	62	6	
5_N_3		67	62	5	
5_N_4/MON-08	60	67	62	5	
5_N_5		67	62	5	
5_N_6		65	61	4	
5_N_7		66	62	4	
5_N_8		67	62	5	
5_N_9/MON-09	62	67	62	5	
5_N_10		67	62	5	
5_N_11		65	61	4	
5_N_12		63	59	4	
5_N_13		65	59	6	
5_N_14		65	59	6	
5_N_15		65	60	5	
5_N_16		63	59	4	
5_N_17		64	60	4	
5_N_18		65	62	3	
5_N_19		63	61	2	
5_N_20		61	59	2	
5_N_21		63	59	4	
5_N_22		65	60	5	
5_N_23/MON-10	59	67	61	6	
5_N_24		66	60	6	
5_N_25		66	60	6	

- Modeled Receivers \geq 64 dBA

Barrier 05 is recommended at the existing noise wall location with an extension approximately 1,180 feet to the north of the existing wall terminus. Barrier 05 would provide noise attenuation for 52 impacted customers. The height of the barrier would be approximately 14 to 20 feet. The barrier cost is shown in Table 13.

TABLE 13 BARRIER SUMMARY LOCATION 05				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 05 (Peoria, SR 101, Peoria Avenue to Grand Avenue)	2,693	14-20	44,546	\$1,842,320*
* Barrier cost includes remove and replace fee of \$60,480 for the existing noise barrier (1,512 ft).				

LOCATION 06

Location 06 is located on the west side of SR 101 between Olive Avenue and Peoria Avenue in the City of Peoria. As shown in Table 14, location 06 has 34 modeled noise receivers, representing approximately 70 adjacent customers. The noise levels at 34 modeled noise receivers are equal to or greater than 64 dBA, representing approximately 70 impacted customers.

TABLE 14 PREDICTED NOISE LEVEL RESULTS LOCATION 06					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
6_N_1		65	64	1	Barrier 06
6_N_2		66	60	6	
6_N_3		67	59	8	
6_N_4/MON-11	61	69	61	8	
6_N_5		69	62	7	
6_N_6		68	63	5	
6_N_7		69	63	6	
6_N_8		68	63	5	
6_N_9		69	63	6	
6_N_10		69	62	7	
6_N_11		68	63	5	
6_N_12		68	62	6	
6_N_13		68	62	6	
6_N_14		67	62	5	
6_N_15		67	62	5	
6_N_16		68	63	5	
6_N_17		68	62	6	
6_N_18/MON-12	63	68	62	6	
6_N_19/MON-13	53	64	60	4	
6_N_20		68	62	6	
6_N_21		67	62	5	
6_N_22		68	63	5	
6_N_23		68	62	6	
6_N_24		69	63	6	
6_N_25		69	63	6	
6_N_26		69	63	6	
6_N_27		69	63	6	
6_N_28		70	63	7	
6_N_29		69	63	6	
6_N_30/MON-14	63	71	62	9	
6_N_31		68	63	5	
6_N_32		69	62	7	
6_N_33		68	60	8	
6_N_34		67	60	7	

- Modeled Receivers \geq 64 dBA

Barrier 06 is recommended for customers in this neighborhood. Barrier 06 would replace the existing 8 foot privacy wall and wrap around the corner area on both ends of the neighborhood. Barrier 06 would provide noise attenuation for 68 impacted customers. The height of the barrier would be approximately 14 to 20 feet. The barrier cost is shown in Table 15.

TABLE 15 BARRIER SUMMARY LOCATION 06				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 06 (Peoria, SR 101, Olive Avenue to Peoria Avenue)	5,115	14-20	86,596	\$3,668,440
* Barrier cost includes remove and replace fee of \$204,600 for the existing privacy wall (5,115 ft).				

LOCATION 07

Location 07 is located on the west side of SR 101 between Northern Avenue and Olive Avenue in the City of Peoria. As shown in Table 16, location 07 has 17 modeled noise receivers, representing approximately 42 adjacent customers. The noise levels at seven modeled noise receivers are equal to or greater than 64 dBA, representing approximately 13 impacted customers.

TABLE 16 PREDICTED NOISE LEVEL RESULTS LOCATION 07					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
7_N_1		59	56	3	Barrier 07
7_N_2		59	57	2	
7_N_3		61	58	3	
7_N_4		63	59	4	
7_N_5/MON-15	64	68	62	6	
7_N_6		67	62	5	
7_N_7		65	60	5	
7_N_8		63	59	4	
7_N_9		69	62	7	
7_N_10		71	63	8	
7_N_11		68	63	5	
7_N_12		65	62	3	
7_N_13		61	59	2	
7_N_14		59	57	2	
7_N_15		58	57	1	
7_N_16		59	59	0	
7_N_17		60	60	0	

- Modeled Receivers ≥ 64 dBA

Barrier 07 is recommended for an elementary school and adjacent customers located on the west side of 95th Avenue. The barrier was not recommended for customers on the north side of Butler Drive because two rows of 30-foot-high commercial buildings and a 9-foot privacy wall exist, which provides shielding effects for these customers. Barrier 07 would provide noise attenuation for 13 impacted customers. The height of the barrier would be approximately 12 to 16 feet. The barrier cost is shown in Table 17.

TABLE 17 BARRIER SUMMARY LOCATION 07				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 07 (Peoria, SR 101, Northern Avenue to Olive Avenue)	2,110	12-16	30,553	\$1,222,120

LOCATION 08

Location 08 is located on the NWC at SR 101 and 90th Street in City of Scottsdale. As shown in Table 18, location 08 has 18 modeled noise receivers, representing approximately 52 adjacent customers. The noise levels at three modeled noise receivers are equal to or greater than 64 dBA, representing approximately eight impacted customers.

TABLE 18 PREDICTED NOISE LEVEL RESULTS LOCATION 08					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
8_S_1		57	56	1	Barrier 08
8_S_2		58	56	2	
8_S_3		63	58	5	
8_S_4/MON-16	59	65	60	5	
8_S_5		65	60	5	
8_S_6		62	58	4	
8_S_7		63	60	3	
8_S_8		59	59	0	
8_S_9		58	58	0	
8_S_10		61	59	2	
8_S_11		59	58	1	
8_S_12		60	59	1	
8_S_13		61	60	1	
8_S_14		60	60	0	
8_S_15		56	56	0	
8_S_16		57	57	0	
8_S_17		54	54	0	
8_S_18/MON-17	61	65	64	1	

- Modeled Receivers ≥ 64 dBA

Barrier 08 is recommended for adjacent customers on the southbound side of the freeway. Barrier 08 would provide noise attenuation for eight impacted customers. The height of the barrier would be approximately 10 to 18 feet as measured from the freeway side. The barrier cost is shown in Table 19.

TABLE 19 BARRIER SUMMARY LOCATION 08				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 08 (Scottsdale, SR 101 & 90th Street)	1,757	10-18	27,251	\$1,160,320*
* Barrier cost includes remove and replace fee of \$70,280 for the existing noise barrier (1,757 ft).				

LOCATION 09

Location 09 is located on the NWC at SR 101 and Cactus Road in the City of Scottsdale. As shown in Table 20, location 09 has 20 modeled noise receivers, representing approximately 31 adjacent customers. The noise levels for all modeled noise receivers are less than 64 dBA, therefore no impacted customers exist in this neighborhood.

TABLE 20 PREDICTED NOISE LEVEL RESULTS LOCATION 09					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
9_S_1		58	56	2	Barrier 09
9_S_2		55	54	1	
9_S_3		62	60	2	
9_S_4		57	55	2	
9_S_5		63	60	3	
9_S_6		57	55	2	
9_S_7		63	60	3	
9_S_8		58	55	3	
9_S_9		62	60	2	
9_S_10		57	55	2	
9_S_11		62	60	2	
9_S_12		57	55	2	
9_S_13		61	60	1	
9_S_14		58	56	2	
9_S_15		59	58	1	
9_S_16		61	60	1	
9_S_17		58	57	1	
9_S_18		55	55	0	
9_S_19/MON-18	56	61	59	2	
9_S_20/MON-19	56	57	56	1	

- Modeled Receivers ≥ 64 dBA

Barrier 09 is evaluated for adjacent customers on the southbound side of the freeway. The height of the barrier would need to be approximately 12 to 14 feet high to achieve a 3 dBA noise reduction. Barrier 09 would replace the existing 8 foot privacy wall and connect to the existing 11-foot-high noise barrier to the north. Because of this comparatively low predicted noise levels, further evaluation may be needed to justify the feasibility for this noise barrier. The barrier cost is shown in Table 21.

TABLE 21 BARRIER SUMMARY LOCATION 09				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 09 (Scottsdale, SR 101 & Cactus Road)	2,125	12-14	29,100	\$1,249,000*
* Barrier cost includes remove and replace fee of \$85,000 for the existing privacy wall (2,125 ft).				

LOCATION 10

Location 10 is located on the NWC of SR 51 and Greenway Parkway in the City of Phoenix. As shown in Table 22, location 10 has 14 modeled noise receivers, representing approximately 22 adjacent customers. The noise level at one modeled noise receiver is equal to or greater than 64 dBA, representing approximately two impacted customers.

TABLE 22 PREDICTED NOISE LEVEL RESULTS LOCATION 10					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
10_S_1		59	58	1	Barrier 10
10_S_2		58	57	1	
10_S_3		58	56	2	
10_S_4		58	56	2	
10_S_5		56	54	2	
10_S_6		58	55	3	
10_S_7		58	56	2	
10_S_8		57	55	2	
10_S_9		57	55	2	
10_S_10/MON-20	56	59	56	3	
10_S_11		58	56	2	
10_S_12		59	56	3	
10_S_13		62	59	3	
10_S_14		64	59	5	

- Modeled Receivers ≥ 64 dBA

Barrier 10 is recommended to protect customers adjacent to the westbound side of the freeway. Barrier 10 would provide noise attenuation for two impacted customers. The height of the barrier would be approximately 12 to 16 feet. It would be designed at the existing noise barrier location on the south end and extend along the existing berm area and connect to the existing noise barrier to the north. The barrier cost is shown in Table 23.

TABLE 23 BARRIER SUMMARY LOCATION 10				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 10 (Phoenix, SR 51 & Greenway Parkway)	1,899	12-16	24,301	\$992,040*
* Barrier cost includes remove and replace fee of \$20,000 for the existing noise barrier (500 ft).				

LOCATION 11

Location 11 is located on the southbound side of SR 303 between Deer Valley Road and north of Robertson Drive in unincorporated portions of Maricopa County. As shown in Table 24, location 11 has 17 modeled noise receivers, representing approximately 20 adjacent customers. The noise levels at 16 modeled noise receivers are equal to or greater than 64 dBA, representing approximately 19 impacted customers.

TABLE 24 PREDICTED NOISE LEVEL RESULTS LOCATION 11					
Noise Receiver Locations	Noise Level (Leq), dBA				Recommended Reduction Measure
	Monitored	TNM 2.5 Model			
		Unmitigated	Mitigated	Insertion Loss	
11_E_1		66	63	3	Barrier 11
11_E_2		67	63	4	
11_E_3		68	63	5	
11_E_4		68	63	5	
11_E_5		69	63	6	
11_E_6		72	63	9	
11_E_7		70	63	7	
11_E_8		69	62	7	
11_E_9		70	62	8	
11_E_10		69	61	8	
11_E_11		67	61	6	
11_E_12		62	59	3	
11_E_13		65	60	5	
11_E_14		65	61	4	
11_E_15		65	60	5	
11_E_16		67	62	5	
11_E_17/MON-21	59	70	63	7	

- Modeled Receivers ≥ 64 dBA

Barrier 11 is recommended for customers in this neighborhood. The barrier would replace the existing 5 to 6 foot privacy wall. Barrier 11 would provide noise attenuation for 19 impacted customers. The height of the barrier would be approximately 8 to 16 feet. The barrier cost is shown in Table 25.

TABLE 25 BARRIER SUMMARY LOCATION 11				
Barrier Description	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 11 (Maricopa County, SR 303, Deer Valley Road and North of Robertson Drive)	2,283	8-16	28,935	\$1,248,720*
* Barrier cost includes remove and replace fee of \$91,320 for the existing privacy wall (2,283 ft).				

5.0 CONCLUSION

This final noise study technical report evaluates the noise levels and makes noise reduction recommendations for 11 potential noise barrier locations within Maricopa County. Barriers are recommended for customers in Location 01 through Location 11. Table 26 summarizes the recommended noise barriers.

Table 26 BARRIER SUMMARY					
Barrier Description	Jurisdiction	Barrier Length (ft)	Barrier Height Range (ft)	Area of Barrier (ft ²)	Barrier Cost
Barrier 01	Phoenix	1,353	10-14	15,078	\$603,120
Barrier 02	Phoenix	2,738	14-18	41,638	\$1,775,040
Barrier 03	Phoenix	1,521	12-16	23,563	\$1,003,360
Barrier 04	Phoenix	1,452	16-18	24,519	\$867,207
Barrier 05	Peoria	2,693	14-20	44,546	\$1,842,320
Barrier 06	Peoria	5,115	14-20	86,596	\$3,668,440
Barrier 07	Peoria	2,110	12-16	30,553	\$1,222,120
Barrier 08	Scottsdale	1,757	10-18	27,251	\$1,160,320
Barrier 09	Scottsdale	2,125	12-14	29,100	\$1,249,000
Barrier 10	Phoenix	1,899	12-16	24,301	\$992,040
Barrier 11	Maricopa County	2,283	8-16	28,935	\$1,248,720
Total for Barriers:		25,046	8-20	376,080	\$15,631,687

Appendix A provides the locations of the recommended noise barriers. The recommended barrier locations and endpoints in this report are for illustrative purposes only and are subject to adjustment during final design.